MINISTRY OF EDUCATION YOUTH AND SPORTS ACCRA, GHANA

Trends in International Mathematics and Science Study

TIMSS-2003

Results from Ghanaian Junior Secondary 2 students' participation in TIMSS-2003 in Mathematics and Science

UEW/GES Inspectorate Div. December 2004

TIMSS-2003 is the third in a series of studies undertaken once every four years by the International Association for the Evaluation of Educational Achievement (IEA). TIMSS-2003 seeks to continue to monitor trends in science and mathematics at the eighth grade (JSS2) and at the fourth grade (Primary 4). Ghana's participation in TIMSS-2003 was strategic as it enabled the country to find out how the performance of her eighth graders (JSS2) in science and mathematics compared with those of other countries. This report[1] represents an overview of findings from TIMSS-2003.

Key Points

[1] This summary was compiled by Anamuah-Mensah, J., Mereku, D. K. and Asabere-Ameyaw, A., all of the University of Education, Winneba, in December 2004. For the full report, see Anamuah-Mensah, J., Mereku, D. K. and Asabere-Ameyaw, A. (2004). *Ghanaian Junior Secondary School Students' Achievement in Mathematics and Science: Results from Ghana's participation in the 2003 Trends in International Mathematics and Science Study*, Accra: Ministry of Education Youth and Sports.

- A total of 5,114 junior secondary school students in 150 schools sampled across the country were involved in the study.
- Forty-six countries participated in the TIMSS-2003 with six of them from Africa.

Mathematics Achievement

- Ghana's overall performance in mathematics was poor. This poor performance placed Ghana at the 45th position on the overall mathematics achievement results table.
- The mean percentage correct on all mathematics test items for each participating Ghanaian student was 15.
- Only 9% and 2% of the students reached the low and intermediate international benchmarks, respectively.
- Ghana ranked 46th on the international benchmark for mathematics.
- The students' strong content areas in mathematics were in Number and Data, while their weakest areas were in Algebra, Measurement and Geometry.
- In almost all the content areas, the boys achieved significantly higher scores than the girls.

Science Achievement

- The overall performance of the Ghanaian students in the science test was very low. This placed Ghana at the 45th position on the overall science achievement results table.
- The mean percentage correct on all science test items for each participating Ghanaian student was 19.
- Only 13% and 3% of the students reached the low and intermediate international benchmarks, respectively.
- Ghana ranked 46th on the international benchmark for science.
- The students' strong content areas in the science curriculum were in Chemistry and Environmental Science, while their weakest area was in physics.
- In all the five content areas, the boys achieved higher scores than the girls.

TIMSS-2003 is an international study in mathematics and science achievement. At the international level, TIMSS-2003 was designed to measure trends in students' achievement; it also examined the contexts for learning mathematics and science. The results will be useful in guiding policy in education.

What was TIMSS-2003?

TIMSS-2003 was a large scale cross-cultural study involving Years 4 and 8 students in forty-six countries. Ghana participated at only the eighth grade (i.e. JSS2) level. TIMSS-2003 provided information on students' performance in mathematics and science as well as their attitudes towards these two subjects. At the same time, it provided information on contextual factors such as home environment, curricular intentions and school and classroom environments, which have the potential of influencing their performance.

Ghana's participation in TIMSS-2003 provided the opportunity to examine students' achievement in mathematics and science using an international yardstick and to compare this to that of other countries both within and beyond the continent of Africa. The results will enable policy makers to identify the contextual variables that can be modified to bring about improvement in the

learning and teaching of science and mathematics.

Who carried out TIMSS-2003?

The researchers in the Ghana Education Service responsible for administering TIMSS-2003 in Ghana, worked with a number of research organizations during the different phases of the study.

Each participating country appointed a National Research Coordinator to be responsible for implementing the study in the country. The Inspectorate Division of Ghana Education Service where the National Research Coordinator was based carried out the pilot study and the main data collection activities for TIMSS-2003. The administration was carried out under the auspices of IEA. The International Study Centre (ISC) in Boston College's Lynch School of Education in USA was responsible for the design and implementation of the study. Other bodies that played significant roles in ensuring the success of the study were:

- IEA Data Processing Centre in Hamburg, Germany;
- Statistics Canada, which was responsible for collecting and evaluating the sample and helping participants to adapt the TIMSS sampling design;
- Educational Testing Service in Princeton, New Jersey (USA), which carried out the scaling of the achievement data.

Who took part in TIMSS-2003 in Ghana?

In Ghana, approximately 5100 Junior Secondary 2 students took part in the various aspects of the study.

In Ghana, TIMSS-2003 involved schools with Year 8 (JSS2) students. There were a total of 5,114 students in 150 schools sampled across the country. JSS2 students in the sample were made up of 45 percent girls and 55 percent boys. The mathematics and science teachers of these students, as well as their head teachers, also provided information on the context in which mathematics and science learning was taking place in their schools.

Countries participating in TIMSS-2003

Forty-six countries participated in the TIMSS-2003

Forty-six countries participated in the TIMSS-2003, with six of them from Africa. Three of the countries – Republic of Korea, Malaysia and Singapore - were at about the same level of development as Ghana when Ghana attained its independence in 1957. Below are the participating countries:

Armenia	Ghana*	Lithuania	Saudi Arabia
Australia	Hong Kong, SAR	Macedonia, Rep. of	Scotland
Bahrain	Hungary	Malaysia	Serbia
Belgium (Flemish)	Indonesia	Moldova, Rep. of	Singapore
Botswana*	Iran, Islamic Rep. of	Morocco *	Slovak Republic
Bulgaria	Israel	Netherlands	Slovenia
Chile	Italy	New Zealand	South Africa*
Chinese Taipei	Japan	Norway	Sweden
Cyprus	Jordan	Palestinian, Nat'l Auth	Tunisia*
Egypt*	Korea, Rep. of	Philippines	United States
England	Latvia	Romania	
Estonia	Lebanon	Russian Federation	

*African countries participating in TIMSS-2003

International Students' Achievement

Mathematics

The overall performance of the Ghanaian students on the mathematics test was

In Ghana, the overall performance of the JSS2 students on the mathematics test was poor and was significantly below the international mean.

poor. They obtained a low average scale score of 276 which placed the nation second from the bottom of the overall mathematics results table, doing slightly better than only South Africa (Table 1). See full table of results in Appendix A on page 26.

Table 1 The overall mean mathematics achievement score

Country	Overall Mean Achievement (se)
Ghana	**276 (4.7)**
Countries Comparable to Ghana at its independence	
Singapore	605 (3.6) h
Korea	589 (2.2) h
Chinese Taipei	585 (4.6) h
Japan	570 (2.1) h
Malaysia	508 (4.1) h
Countries with strong links to Ghana	
England	498 (4.7) h
USA	498 (4.7) h
African Countries	
Tunisia	410 (2.2) h
Egypt	406 (3.5) h
Morocco	396 (2.5) h
Botswana	366 (2.6) h
South Africa	264 (5.5) i
International Average	**467 (0.5) h**

*The symbol h indicates the country mean is significantly higher than Ghana mean
The symbol i indicates the country mean is not significantly different from Ghana mean

There was a large variation in mathematical abilities among the students with some scoring as low as 130 and others scoring as high as 430. As can be seen from the table, the overall score of 276 obtained was far below the international mean of 467. The mean percentage correct on all test items for each participant was 15%. That is, on the average each student obtained only 15% of the items correct.

In Ghana, the overall achievement of the JSS2 students on the science test was poor and was also significantly below the international mean.

Science

The overall performance of the Ghanaian students on the science test was very low. The low mean scale score of 255 placed the nation second from the bottom of the overall science results table, again doing slightly better than only South Africa (Table 2). Ghana thus ranked 45th on the test. See full table of results in Appendix B on page 27. There was a much larger variation in science abilities among the students with some scoring as low as 52 and others scoring as high as 450.

Table 2 The overall mean science achievement score

Country	Overall Mean Achievement (se)
Ghana	**255 (5.9)**
Countries Comparable to Ghana at its independence	
Singapore	578 (4.3) h
Chinese Taipei	571 (3.5) h
Japan	552 (1.7) h
Malaysia	510 (3.7) h

Korea	558 (1.6) h
Countries with strong links to Ghana	
England	544 (4.1) h
USA	527 (3.1) h
African Countries	
Egypt	421 (3.9) h
Tunisia	404 (2.1) h
Morocco	396 (2.5) h
Botswana	365 (2.8) h
South Africa	244 (6.7) i
International Average	474 (0.6) h

*The symbol h indicates the country mean is significantly higher than Ghana mean
The symbol i indicates the country mean is not significantly different from Ghana mean

The mean percentage correct on all test items for each participant was 19%. That is, on the average each student obtained only 19% of the items correct.

The performance of all the students can be described in terms of international benchmarks. Students reaching a specific benchmark exhibit not only the knowledge and understandings that characterise the benchmark but also the knowledge and understandings of students at the lower benchmark.

International Benchmarks

TIMSS-2003 mathematics and science achievement scales summarise Year 8 (JSS2) students' performance on test items designed to measure a wide range of student knowledge and understanding. Four points on each scale were identified for use as international benchmarks. The performance of all the students in all countries which participated in TIMSS-2003 were taken into account when defining these benchmarks, which are described as follows:

~ *Advanced International Benchmark* corresponding to a scale score of 625,
~ *High International Benchmark* corresponding to a scale score of 550,
~ *Intermediate International Benchmark* corresponding to a scale score of 475, and
~ *Low International Benchmark* corresponding to a scale score of 400.

At the lower benchmark in science, students' performance reflected elementary knowledge of basic science facts but at the advanced benchmarks, students' performance reflected the use of more abstract conceptual knowledge and scientific inquiry, in addition to the basic knowledge. Similarly, at the lower benchmark in mathematics, students' performance reflected acquisition of some basic mathematical knowledge such as addition, subtraction and multiplication of numbers whereas at the advanced benchmark, students' performance reflected the use of relatively complex algebraic and geometric concepts and relationships.

Performance against the international benchmarks: Science

Overall, Ghana ranked 46th on the international benchmark in science. Only 13% and 3% of Ghanaian students reached the low and intermediate international benchmarks respectively, as can be seen in Table 3.

In science, over 80% of the students did not reach the

Table 3 Percentages of Students Reaching TIMSS-2003 International Benchmarks of Science Achievement in Ghana and Selected Countries

Countries	Percentage of students reaching international benchmark			
	Advanced	High	Intermediate	Low

low international benchmark. This implies the majority of our students have poor knowledge of basic science facts and weak grasp of science concepts and enquiry skills, which are lower level cognitive competencies.

	International Benchmark	International Benchmark	International Benchmark	International Benchmark
Countries Comparable to Ghana at its independence				
Singapore	33	66	85	95
Chinese Taipei	26	63	88	98
Korea, Rep. of	17	57	88	98
Japan	15	53	86	98
Malaysia	4	28	71	95
African Countries				
Egypt	1	10	33	59
South Africa	1	3	6	13
Morocco	0	1	13	48
Tunisia	0	1	12	52
Botswana	0	1	10	35
Ghana	**0**	**0**	**3**	**13**
Countries with strong links to Ghana				
England	15	48	81	96
United States	11	41	75	93
International Average	6	25	54	78

Over 80% of the students not reaching the low international benchmark implies that majority of our students have poor knowledge of basic science facts and weak grasp of science concepts and enquiry skills which are lower level cognitive competencies. No student reached the high or advanced international benchmarks in science.

Countries such as Japan, Singapore, Malaysia, USA and England with almost all students reaching the benchmark have educational systems that do excellent job of educating all its students. The educational system in Ghana where only 13 percent of the students reached the low benchmark does not appear to provide adequate preparation for its students. The low percentage of Ghanaian students reaching the higher benchmarks suggests the need to assist students to build a sound grounding in the mastery of basic knowledge and skills required to solve more cognitively demanding problems.

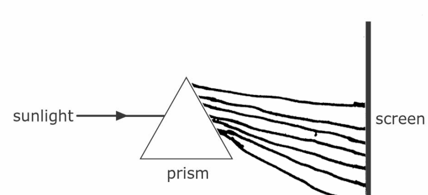
The educational system in Ghana where only 13 percent of the students reached the low benchmark does not appear to provide adequate preparation for its students.

Figures 1 and 2 present two examples of science items students are likely to answer correctly (i.e. what they know and can do) at each benchmark. For each item, the proportion of Ghanaian JSS2 students answering correctly is displayed together with the percentage of students who answered correctly in selected countries as well as the international mean. For multiple-choice items, the correct answer is circled, whereas in the case of open-ended items, the answers shown depict the type of student answers that were given full credit.

Figure 1 Example of science items likely to be answered correctly by students reaching the advanced international benchmarks

Advanced International Benchmark
Content Area: Physics
Topic: Light
Cognitive Domain: Conceptual understanding

The diagram shows a ray of sunlight entering a glass prism.



Country	Overall % correct
Ghana	**1**
Korea	74
Singapore	65
Malaysia	53
Chinese Taipei	38
Japan	10

Example of science items likely to be answered correctly by students reaching the advanced international benchmarks.

The items in the Advanced International Benchmark seem to be very challenging to the students. In Example 1, only 23 percent got the correct answer. Ghana's performance on this item was very poor as only 1.0 percent received full credit. With the exception of Chinese Taipei, more than half of the students in the other South East Asia countries received full credit for their responses. With respect to African countries, the performance of Ghana was comparable to Tunisia and Morocco.

In Figure 2 is a science item that students reaching the High International Benchmark are likely to answer correctly. The item requires students to predict the effect of the removal of an organism in an ecosystem and a food chain. Ghana had the least score with only 3 percent of JSS2 students achieving full credit. Botswana and South Africa had 6 percent of the students achieving full credit whereas 34 percent of students in Egypt did so. Also, in comparison to Ghana, over a third of the East Asian countries – Singapore, Malaysia, Japan, Korea and Taipei – obtained full credit.

Figure 2 Example of science items likely to be answered correctly by students reaching the high international benchmarks

Area: Life Science
Topic: Ecosystems
Cognitive Domain: Reasoning and analysis

Country	Overall % Correct
Ghana	**3**
Singapore	78
Malaysia	68
Chinese Taipei	55
Korea, Rep. of	38
Japan	31
England	57
USA	44
Egypt	34
Tunisia	26
Morocco	16
Botswana	6
South Africa	6
International Mean	**33**

Example of science items likely to be answered correctly by students reaching the high

international benchmarks.

The diagram above shows a community consisting of mice, snakes and wheat plants.

What would happen to this community if people killed the snakes?

Because there are no snakes, we would get more mice. This would cause less wheat plants.

In mathematics, over 80% of the students did not reach the low international benchmark. This implies that majority of our students have no good grasp of knowledge and conceptual understanding of basic mathematical principles, and could therefore not apply these in the problem situations.

Performance against the international benchmarks: Mathematics

Ghana ranked 46th on the international benchmark for mathematics. Only 9% and 2% of the students reached the low and intermediate international benchmarks, respectively (Table 4). Ghana had no student reaching the advanced international benchmark and the high international benchmark. This shows that the JSS2 students in Ghana did not have a good knowledge and conceptual understanding of basic mathematical principles and could therefore not apply these in the problem situations. In addition, the less than 10 percent of Ghanaian JSS2 students reaching the low benchmark indicates that Ghana is doing a poor job of educating all its students, that is, giving them basic mathematical knowledge and skills.

Table 4 Percentages of Students Reaching TIMSS-2003 International Benchmarks of Mathematics Achievement in Ghana and Selected Countries

Countries	Percentages of Students Reaching International Benchmark			
	Advanced International Benchmark	High International Benchmark	Intermediate International Benchmark	Low International Benchmark
Countries Comparable to Ghana at its independence				
Singapore	44	77	93	99
Chinese Taipei	38	66	85	96
Korea, Rep. of	35	70	90	98
Japan	24	62	88	98
Malaysia	6	30	66	93
African Countries				
Egypt	1	6	24	52
South Africa	0	2	6	10
Morocco	0	1	10	42
Tunisia	0	1	15	55
Botswana	0	1	7	32
Ghana	**0**	**0**	**2**	**9**
Countries with strong links to Ghana				
England	5	29	64	90
United States	7	41	75	93
International Average	6	24	51	75

Figure 3 presents an example of an item in mathematics that provides concrete notions of the abilities students were able to demonstrate at the advanced benchmarks. The proportion of Ghanaian JSS2 students answering the item correctly is displayed together with the percentage of students who answered correctly in selected countries.

Example of mathematics items likely to be answered correctly by students reaching the advanced international benchmarks.

Figure 3 Example of mathematics items likely to be answered correctly by students reaching the advanced international benchmarks

Advanced International Benchmark
Content Area: Algebra
Topic: Patterns
Cognitive Domain: Solving routine problems

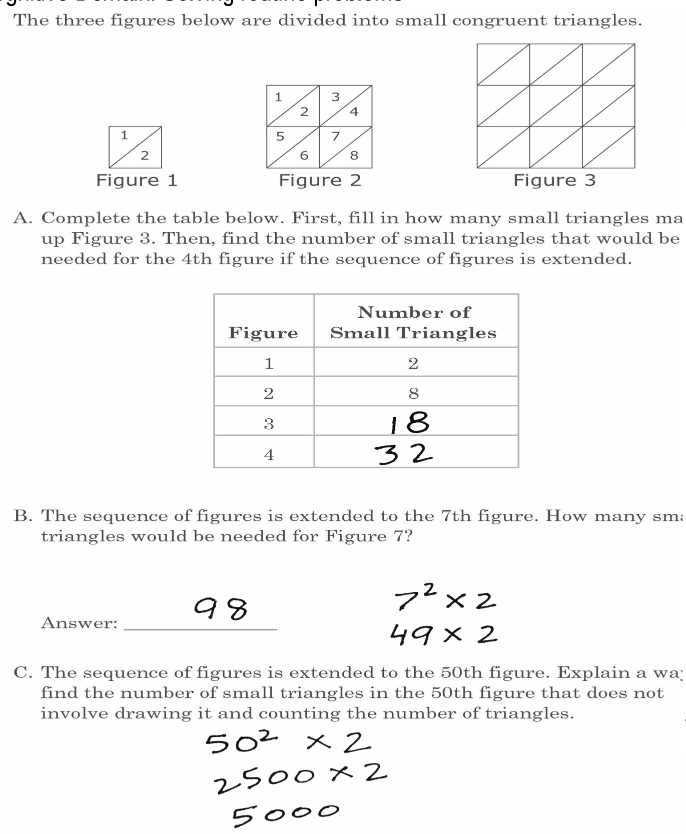

The three figures below are divided into small congruent triangles.

Figure 1 Figure 2 Figure 3

A. Complete the table below. First, fill in how many small triangles ma up Figure 3. Then, find the number of small triangles that would be needed for the 4th figure if the sequence of figures is extended.

Figure	Number of Small Triangles
1	2
2	8
3	18
4	32

B. The sequence of figures is extended to the 7th figure. How many sm: triangles would be needed for Figure 7?

Answer: 98 $7^2 \times 2$ 49×2

C. The sequence of figures is extended to the 50th figure. Explain a wa: find the number of small triangles in the 50th figure that does not involve drawing it and counting the number of triangles.

$50^2 \times 2$
2500×2
5000

Country	Overall % (
Ghana	**1**
Chinese Taipei	49
Korea, Rep of	48
Singapore	44
Japan	44
Malaysia	10
England	20
USA	19
Egypt	5
Morocco	2
Botswana	2
South Africa	1
Tunisia	1
International mean	**14**

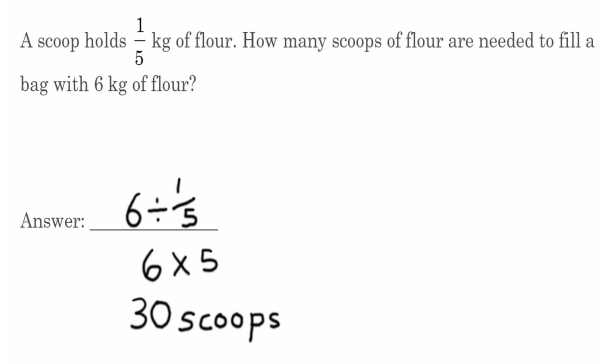
Figure 4 is an item that students reaching the high international benchmark in mathematics are likely to answer correctly. Only 6 percent of Ghanaian JSS2 students received full score, far below the international average of 38 percent. In contrast to the performance of Ghanaian students, the Asian countries had higher proportion of students getting the full score; this ranged from Malaysia with eight times more students to Singapore with 13 times more students obtaining the correct answer. In England and USA, students who gave the correct response were more than eight times that of Ghana. Ghana's performance was only comparable to that of South Africa (7%) and Morocco

Example of mathematics item likely to be answered correctly by students reaching the high international benchmarks.

(8%).

Figure 4 Example of mathematics items likely to be answered correctly by students reaching the high international benchmarks

High International Benchmark
Content Area: Number
Topic: Fractions and decimals
Cognitive Domain: Knowing facts and procedures



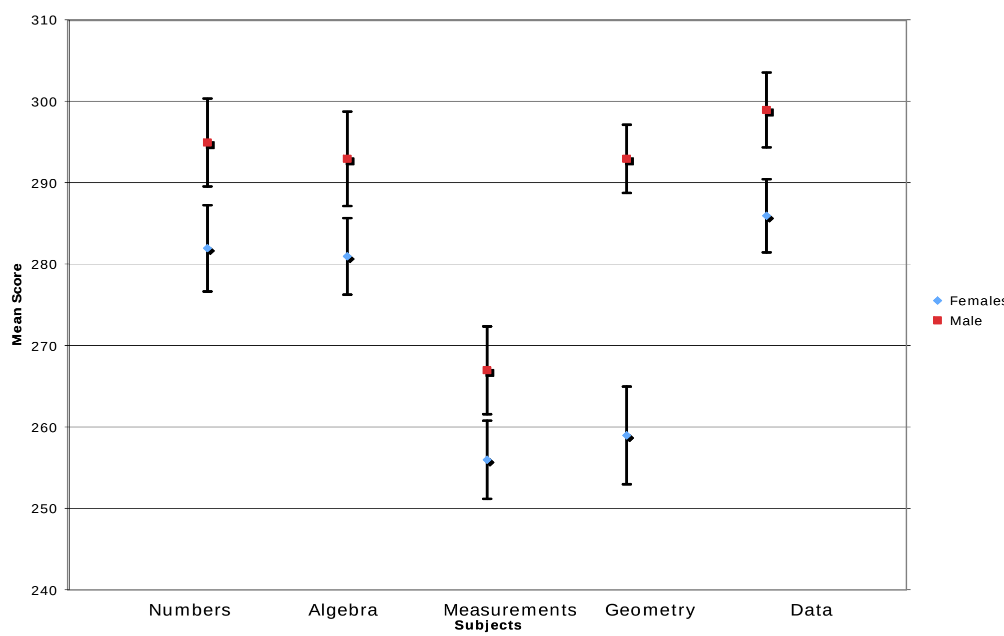
Country	Overall % correct
Ghana	**6**
Singapore	79
Chinese Taipei	75
Korea, Rep of	68
Japan	62
Malaysia	47
USA	52
England	50
Tunisia	18
Egypt	17
Botswana	11
Morocco	8
South Africa	7

Gender differences

Gender differences in achievement in mathematics content areas among JSS2 students.

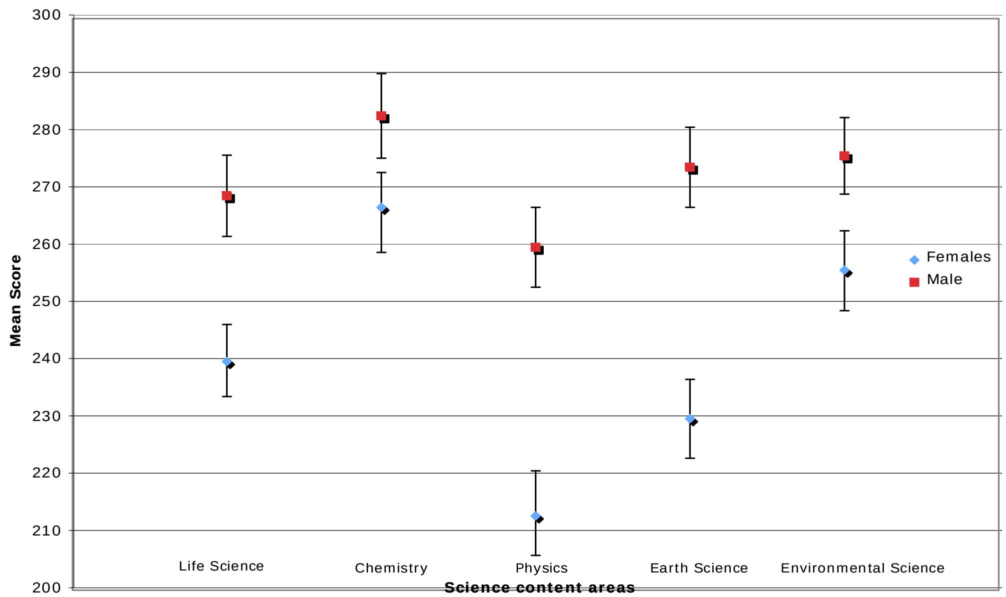
Overall, boys performed better than girls in both mathematics and science as shown in Figures 5 and 6. In all the mathematics content areas except measurement, there was a statistical difference between girls' and boys' mean achievement with the boys achieving higher scores than the girls. In science, the boys performed better than the girls in all the content areas.

Figure 5 Gender differences in achievement in mathematics content areas among JSS2 student



Gender differences in achievement in science content areas among JSS2 students.

Figure 6 JSS2 students' mean scores for the overall and the five science content reporting categories areas by gender



Achievement in mathematics and science content areas

The mathematics assessment framework for TIMSS-2003 was covered by two organising dimensions - a content dimension and a cognitive dimension. There were five content domains:

- Number,
- Algebra,
- Measurement,
- Geometry, and
- Data.

Students' performance in all the five mathematics content areas were significantly lower than the international means.

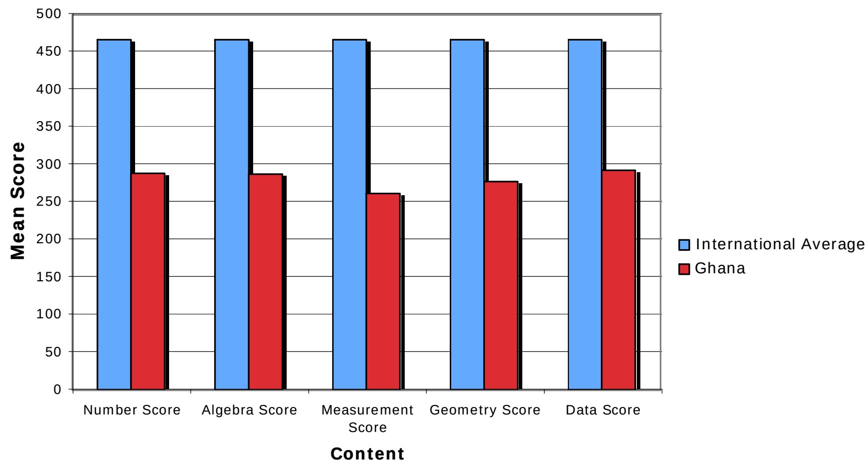
Items in these content domains were designed to elicit the use of particular cognitive skills in four cognitive domains, namely, knowing facts and procedures; using concepts; solving routine problems; and reasoning.

In terms of the type of items used, 21.6% of the students obtained responses on multiple-choice items as compared with 12.1% that got correct responses on constructed response items (from released items)**.**

Performance of the Ghanaian JSS2 student in all the five mathematics content areas was as follows: Number, 289; Algebra, 288; Measurement, 262; Geometry, 278, and Data, 293. These mean scores were significantly lower than the international means in each of the content areas (474) (see Figure 7).

In terms of the type of items used, 21.6% of the students obtained responses on multiple-choice items as compared with 12.1% that got correct responses on constructed response items.

Fig. 7 Relative strengths of JSS2 students' in the mathematics content areas tested in TIMSS-2003



Although Ghanaian JSS2 students were weak in all the content areas, their relative strengths were in the Data and Number domains while their worst performance was in Algebra, Measurement and Geometry.

The science assessment framework for TIMSS-2003 was framed by two organising dimensions - namely, a content dimension and a cognitive dimension. There were five content domains:

- Life science,
- Chemistry,
- Physics,
- Earth Science, and
- Environmental Science.

Students' performance in all the five science content areas were significantly lower than the international means.

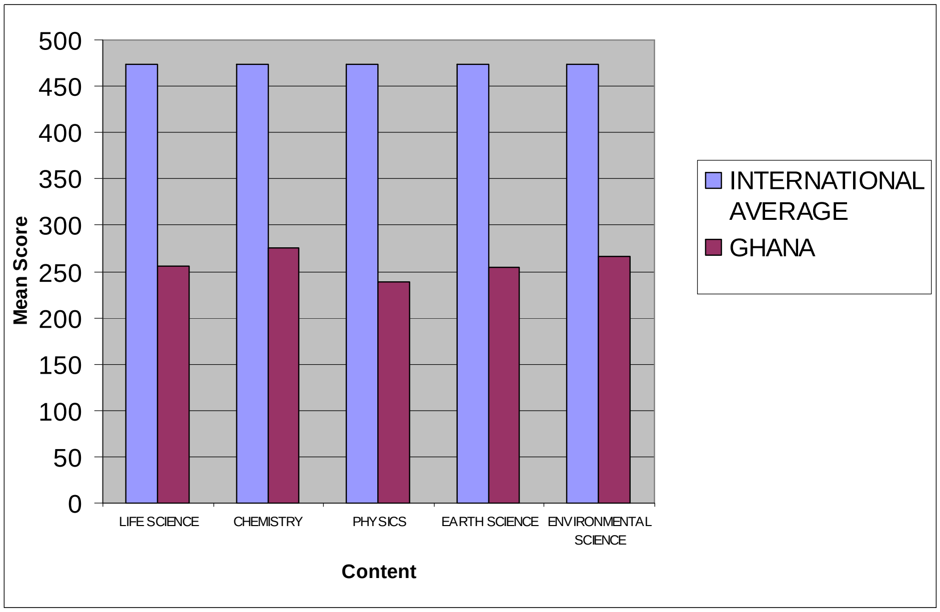
Items in these content domains were designed to elicit the use of particular cognitive skills in three cognitive domains, namely, factual knowledge, conceptual understanding, and reasoning and analysis.

Performance of the Ghanaian JSS2 student in all the five science content areas was as follows: Life Science, 256; Chemistry, 276; Physics, 239; Earth Science, 254; and Environmental Science, 267. These means were significantly lower than the international means in each of the content areas (474) as illustrated in Figure 8. Although Ghanaian JSS2 students were weak in all the content areas, their relative strength was in Chemistry while their worst performance was in Physics.

In terms of the type of items used, 29.6% of the students obtained responses on multiple-choice items as compared with 5.1% that got correct responses on constructed response items (from released items)**.**

In terms of the type of items used, 29.6% of the students obtained responses on multiple-choice items as compared with 5.1% that got correct responses on constructed response items.

Fig. 3.2: Relative strengths of JSS2 students' in the content areas tested in TIMSS-2003



Information on students' backgrounds and attitudes towards mathematics and science, teachers' background, classroom characteristics and school contexts for learning and instruction

To provide a context for interpreting the achievement results, detailed information on students' home backgrounds, how they spend their time out of school and their attitude towards mathematics and science was gathered from the students taking part in the study. The mathematics and science teachers of these students, as well as their head teachers, were also made to provide information on the context in which mathematics and science learning was taking place in their schools.

Some of the findings about the context in which mathematics and science learning was taking place in the schools are presented in the final part of this report.

Students' Background Characteristics

Parents' educational background

Majority of students (37%) had parents whose highest level of education was junior secondary school.

Parents are the first models and most important educators for children, and their educational attainment may serve as a source of aspiration for them. Majority of students (37%) had parents whose highest level of education was junior secondary school. Ten percent of Ghanaian students had had university-educated parents, 17 percent had parents who finished post-secondary

vocational/technical education but not university and 14 percent had no more than primary education. The results indicate a positive correlation between the level of education of the parent and achievement of the child/children in school. That is, higher levels of parents' education were associated with higher students' achievement in science and mathematics.

The results indicate a positive correlation between the level of education of the parent and achievement of the child/children in school.

Student's Educational Aspiration

Majority of the students (67%) did not expect to complete university education; however, about a quarter of the students (27%) had high expectations for university education. Out of this, 6 percent aspired to have university education just as their parents. Twenty-one percent aspired to finish university education even though neither parents had university education. Students with higher aspirations performed better in science and mathematics than those who did not have such aspirations.

Students with higher aspirations performed better in science and mathematics than those who did not have such aspirations.

Self-confidence

About two-thirds of JSS students (57%) expressed high self-confidence in learning science, while 43% expressed high self-confidence in learning mathematics. Having high self-confidence in science and mathematics seemed to be associated with better performance in science and mathematics.

Having high self-confidence in science and mathematics seemed to be associated with better performance in science and mathematics.

Students' valuing science and mathematics

Ghanaian JSS students placed a high value on science and mathematics, with 83 percent and 82 percent respectively classified in the high category. However, this positive attitude did not reflect on their general performance in science and mathematics. Students who have high value for science generally had a higher mean achievement compared to those with medium or low value for science. In mathematics, there was no linear relationship between value placed on the subject and achievement.

Students who have high value for science generally had a higher mean achievement.

Leisure activities during a normal school day

Students spent most of their leisure time reading books, doing jobs at home, playing sports and playing or talking with friends. However, the major activity at leisure time, reading a book for enjoyment, did not reflect on achievement.

Reading a book for enjoyment, did not reflect on achievement

Time spent on homework and achievement

Most Ghanaian students (about 80%) reported spending at least 1 hour 30 minutes per week doing science and mathematics homework. Time spent on homework was associated with higher achievement in science and mathematics although the differences in score points were small.

Time spent on homework was associated with higher achievement in science and mathematics.

Role of availability of educational resources at home on student achievement

Availability of extensive educational resources in the home has great influence on learning. A greater percentage of students (60%) reported having a study desk/table at home, while 24% reported having computers. Sixteen percent reported having more than 100 books at home, while 68% reported 25% or less.

Educational resources such as books and study tables/desks had positive effect on achievement in

science and mathematics.

Educational resources such as books and study tables/desks had positive effect on achievement in science and mathematics. Having a computer at home, however, did not seem to have positive effect on achievement. Achievement in science and mathematics were negatively related to computer usage either at home, at school or other places.

Students who had the opportunity to speak English Language frequently outside school hours achieved higher mean scores than those who spoke it less frequently.

English Language usage and achievement

Majority (68%) of JSS2 students in Ghana either never spoke English or did so sparingly. Students from homes where English Language is always or almost always spoken achieved higher mean scores than those who spoke it less frequently.

Curriculum

Approaches and processes emphasised in mathematics and science

A lot of emphasis is placed on learners knowing basic science facts, understanding science concepts, learning about the nature of science.

In the intended science curriculum, a lot of emphasis is placed on learners knowing basic science facts, understanding science concepts, learning about the nature of science and enquiry and writing explanations about what is observed and why what is observed happens. However, less emphasis is put on hypotheses formulation or prediction, integrating science with other subjects, understanding human impacts on the environment, designing and planning experiments or investigations, learning about technology and its impact on society, conducting experiments or investigations and incorporating the experiences of different ethnic groups.

Emphasis is placed on mastering basic skills, understanding mathematical concepts and principles.

In the intended mathematics curriculum, a lot of emphasis is placed on mastering basic skills, understanding mathematical concepts and principles, applying mathematics in real life contexts, communicating mathematically, and integrating experiences of different cultural groups. The mathematics curriculum gives some emphasis to integrating mathematics with other subjects, but places no emphasis on deriving formal proofs.

TIMSS topics included in the intended curriculum and provisions for differentiation of content

In Ghana, 95% of TIMSS topics were expected to be taught to every student. The proportion of TIMSS topics in the five domains of science are as follows:

Life Science, 100%; Chemistry, 88%; Physics, 90%; Earth Science, 100%; Environmental Science, 100%.

These indicate a great deal of the science content in the TIMSS-2003 assessment were included in the National Curriculum.

Almost all the science and mathematics topics covered in the TIMSS-2003 assessment were included in the National Curriculum.

In the mathematics curriculum, 96% of TIMSS topics were expected to be taught to every student. The proportion of TIMSS topics in the five domains of mathematics are as follows: Number, 100%, Algebra, 100, Measurement, 100,

Geometry, 100, Data, 75.

In mathematics also, a good deal of the mathematics content in the TIMSS-2003 assessment was included in the National Curriculum.

No provisions are made in the mathematics and science syllabuses and textbooks for differentiating the intended curriculum to meet the capabilities of groups of students with varying abilities.

No provisions are made in the mathematics and science syllabuses and textbooks for differentiating the intended curriculum to meet the capabilities of groups of students with varying abilities. All students are made to experience the curriculum with the same difficulty levels. This is however not so in many parts of the world today. This is because some of the content found in the curricula at this level, in many educational systems, have been found not to be essential knowledge for ALL, but additional (or good to know) knowledge for the few who will continue to study the subjects in their further education after this level.

Singapore, where the best results were reported in both subjects, practices even a more extreme form of the differentiation

The results show that the performance in countries that address this issue is high. Singapore, where the best results were reported in both subjects, practices even a more extreme form of the differentiation in which the different curricula are meant for different groups of students according to their ability level.

TIMSS topics taught by the teachers

The teachers' responses indicate that the average proportions of students taught all the TIMSS-2003 science and mathematics topics were 48% and 60% respectively.

In science, TIMSS-2003 covered 44 science topics: Life Science 12; Chemistry 8; Physics 10; Earth Science 11; and Environmental Science 3. The overall average coverage for science was 48%. According to the teachers, the average percentage of students taught the topics in the TIMSS-2003 assessment in the various science domains are as follows:

Life Science	55%
Chemistry	64%
Physics	44%
Earth Science	32%
Environmental Science	49%

In general, less than 50% of the students were taught all the 44 science topics in the intended science curriculum.

The TIMSS-2003 mathematics test covered 45 topics: Number 10, Algebra 6, Measurement 8, Geometry 13, and Data 8. The overall average coverage for mathematics was 60%. According to the teachers, the average percentage of students taught the topics in the TIMSS-2003 assessment in the various mathematics domains are as follows:

Number 83%
Algebra 59%
Measurement 53%
Geometry 51%
Data 55%

The teachers reported Number as the most popular topic and Measurement, Geometry and Data as the least popular topics that students are taught.

Teachers' Characteristics

Certification

Most junior secondary school mathematics and science teachers do not hold university degrees.

Teaching mathematics and science at the Junior Secondary in Ghana requires teacher's certification (Teacher's Certificate A) through supervised practical experience and the passing of examination at the Teacher Training College, but does not require having a university degree. The certification is granted by the Institute of Education, University of Cape Coast.

Gender and age

Half of the students were taught by inexperienced young certificate 'A' teachers who are in their twenties.

In Ghana, 89% of the JSS2 students were taught mathematics and science by male teachers and 11% by female teachers. On the average, the JSS2 mathematics and science teachers reported 8 years teaching experience. About fifty percent of the JSS students were taught by mathematics and science teachers who were 29 years or younger, 30% by teachers between 30 and 39 years, 13% by teachers between 40 and 49 years and 7% by teachers who were 50 years or older. That is, majority of the JSS2 students (80%) were taught by mathematics and science teachers in their twenties and thirties. In fact, half of the students were taught by young and inexperienced teachers in their twenties.

Qualification

A little over eighty percent of the students were taught by mathematics and science teachers with professional teacher's certificate, 9% by teachers with a university degree or its equivalent, 10% by teachers who had finished post secondary education but not university and 12% by teachers who just finished senior secondary school.

Most students (70%) were taught by science teachers who had majored in General Education; 55% were by teachers who majored in a science subject – Life Science, Chemistry or Physics; and 47% were taught by teachers who majored in Science Education. Another 47% of the students were taught by teachers who majored in Mathematics; and 45% taught by teachers who majored in non-science subjects. A large percentage of students were thus taught by teachers who had little or no knowledge in science. [Many teachers reported that their study focused on more than one area.]

With regard to teachers who reported majoring in the sciences, 49% of students were taught by teachers who majored in Biology, 48% by those who majored in Physics and 46% by those who majored in Chemistry. [The percentages indicate that there were teachers who majored in more than one science content area.]

Preparation to teach

JSS mathematics and science teachers receive specific preparation on how to teach the intended science curriculum as part of the teacher's pre-service and in-service training.

Professional development

On the average, about 40% of the students were taught by teachers who indicated that they had had professional development training in science content, pedagogy, information technology, critical thinking/enquiry skills and assessment within the past two years. The highest percentages were for assessment (53%) and content (50%), and the lowest for integrating information technology into science (30%).

Professional interactions among teachers

About a quarter of the students were taught by teachers who never interacted with other teachers.

Less than 50% of the JSS2 students were taught by mathematics and science teachers who reported weekly or monthly interactions with other teachers about teaching strategies, preparing instructional materials, observing another teacher's classroom or having another teacher observe their classroom. This is relatively infrequent for effective professional development. About a quarter of the students were taught by teachers who never interacted with other teachers.

Readiness to teach mathematics and science

The science teachers felt more ready to teach Physics and less ready to teach Earth Science.

Teachers of almost all the JSS2 students felt ready to teach nearly all the topics in the five science content areas. The values ranged from 77 – 98%. With the result above, 90% for all except 2 Earth Science topics (earth's processes, cycles and history, 77%; earth's structure and physical features, 78%), one Life Science topic (role of variations and adaptation/extinction of species in a changing environment, 83%) and one Chemistry topic (chemical change, 87%). The science teachers felt more ready to teach Physics and less ready to teach Earth Science.

Classroom Characteristics

Class size

The average class size of JSS2 was 37. There seemed to be a positive correlation between class size and achievement in mathematics and science. That is, larger classes seemed to perform better than smaller classes. This could be due to the fact that in rural areas in Ghana, where class sizes are generally small, teaching is generally very poor compared to urban areas where class sizes are generally high but have comparatively better teaching and learning resources.

Student characteristics impacting on instruction

Average mathematics and science achievement was related to the impact of students' characteristics (academic abilities, special needs, background, etc.) in the classroom with lower achievement related to classes where there were more instructionally challenging and diverse students.

Instructional time

The greatest percentage of science instructional time was devoted to Life Science (28%), this was followed by Chemistry and Physics (20% each); Earth Science was given 13% while Environmental Science was (15%). In mathematics however, Measurement received the least (14%) instructional time. The remaining content areas received about equal amount (20%) of instructional time.

Extent of student participation in the teaching-learning process

There seemed to be more emphasis on demonstrations instead of group work and students performing their own experiments and/or investigations.

About 73% of students indicated that they watched the teacher demonstrate an experiment/investigation, 75% reported that they were made to relate what is being taught in science to their daily lives. A little over half of the students reported designing or planning an experiment/investigation (54%), conducting an experiment/investigation (55%), and working in small groups on experiments/investigations (54%). More than two thirds said that they were asked to write explanations about what was observed and why it happened. There seemed to be reasonable emphasis on performance of enquiry activities (experiments/investigations). There seemed to be more emphasis on demonstrations instead of group work and students performing their own experiments/investigations.

Teachers of 46% of JSS students reported asking their students to watch them demonstrate an experiment/investigation in at least half of the lessons. Teachers of about 40% of the students reported having their students design or plan experiments/investigation, conduct experiments/investigations (40%), work together in small groups on experiments/investigations (42%), and write explanations about what was observed and why it happened (40%). Teachers of majority of the students (91%) reported getting students to relate what they learn in science to their daily lives.

Majority of mathematics and science teachers reported they used textbooks as supplementary resource since no matching textbooks for the revised curriculum have been supplied to schools.

Textbook usage

Thirty-four percent of JSS2 students had teachers who reported using textbooks as the primary basis of their lessons, 58% had teachers who reported using textbooks as supplementary resource. This is because no matching textbooks for the revised curriculum have been supplied to schools.

The three most predominant activities accounting for class time were listening to lecture style presentations, working problems with teacher's guidance and working problems independently.

Utilisation of class time

The three most predominant activities accounting for 51% of class time were listening to lecture style presentations (17%), working problems with teacher's guidance (18%) and working problems on their own (16%). Two other activities accounting for 26% of class time were listening to teachers re-teach and clarify content/procedures (13%), and taking tests and quizzes (13%).

Computer usage

The national curriculum contains policy statements about the use of computers in teaching, however, on the average computers were not available for 91% of students.

Level of homework and achievement

Teachers used homework as the basis for class discussion and for students to correct errors in their homework in class.

Twenty-nine percent of JSS2 students were in the high category of index of teachers' emphasis on science homework, while another 29% were in the low category and 41% in the medium category. Students in the high category had the lowest science achievement on the average, which suggests homework was probably for remedial purposes.

JSS science teachers reported almost always monitoring whether homework was completed (for 95% of the students on average) and correcting assignments and giving feedback to students (93%). For almost two-thirds of the JSS2 students, teachers reported always or almost always using homework to contribute to students' marks. For more than a third of the students, teachers used homework as the basis for class discussion and for students to correct errors in their homework in class.

Frequency of assessment

On the average, almost three-quarters of students (74%) reported having a science test or an examination every two weeks or more and 24% reported such testing about once every month.

Nature of assessment items and science achievement

Students whose teachers used only constructed response items had lower achievement than those whose teachers used only multiple-choice items or those whose teachers used a combination of multiple-choice and constructed response items.

Seventy percent of JSS2 students had teachers who used constructed response and multiple-choice item formats for their tests or examination in about equal proportion, a little over a quarter had teachers who used only constructed response tests. A very small percentage of students (4%) had teachers who reported using only or mostly multiple-choice items. Students whose teachers used only constructed response items had lower science achievement than those whose teachers used only multiple-choice items or those whose teachers used a combination of multiple-choice and constructed response items. This could be due to the fact that the constructed response items are normally difficult for students.

School Contexts for Learning and Instruction

The achievement of the students decreased as the percentage of economically disadvantaged students increased.

School characteristics

Majority of students (71%) attended schools with more than 50% of students from economically disadvantaged homes, 18% attended schools with 26 - 50% economically disadvantaged students while only 4% attended schools with few (less than 10%) with economically disadvantaged students. Science achievement for students in schools with few students from economically disadvantaged homes (272) was lower than schools with 11 – 25% economically disadvantaged students (293). The achievement of the students decreased as the percentage of economically disadvantaged students increased.

Schools' expectations for parents' involvement

The most common school-related activities that parents were expected to participate in were attending special events such as sporting and science fairs (93%), raising funds for school (93%), ensuring that children's homework was completed (91%), serving on school committees (84%) and volunteering for school projects (82%).

Availability of school resources for science instruction

Eleven percent of the JSS2 students were in schools that were generally unaffected by the lack of resources. Three-quarters of the students (75%) were in schools where instruction was affected by some shortages in school resources.

There was a strong positive correlation between the Heads' perception of the school climate and achievement.

Perception of heads of schools

Over two-thirds (68%) of the students were in schools where the Heads characterised the school climate as medium, 13% were in schools whose climate was described as high while 18% were in schools whose climate could be described as low. There was a strong positive correlation between the Heads' perception of the school climate and achievement in mathematics and science.

There was a positive relationship between teachers' perception of school climate and achievement in mathematics and science.

Teachers' perception

In general, the teachers' perceptions of school climate were in considerable agreement with those of the Heads as they also placed 14% of the students in the high category, 61% in the medium category and 25% in the low category.

Similar to the results for the Heads, there was a positive relationship between teachers' perception of school climate and achievement in mathematics and science. That is high school climate correlated with high achievement, and vice versa.

School attendance

About 70 % of students were in schools where the Heads had judged to have moderate attendance problems, almost a quarter of students (23%) were in schools where there were serious attendance problems and 8% were in schools with few or no attendance problems.

Teachers' perception of safety at school

There was no agreement between teachers' perception of safety in schools and students' perception of being safe in school.

Forty-three percent of the students attended schools where teachers reported to be safe, another 43% were in schools that were moderately safe while 14% were in schools that were reported by teachers not to be safe. There appeared to be no relationship between science achievement in school and teachers' report of school safety.

Students' perception of being safe in school

Thirteen percent of students reported of being safe in school, 38% reported not being safe in school and 49% reported being in schools that were moderately safe. There was a positive relationship between the students' report of being in safer schools and science achievement.

Recommendations

1. Since English is the medium of instruction, its teaching in schools should be strengthened. In addition, problem solving activities in mathematics and science should provide context for teaching students reading and comprehension. Science and mathematics teachers should collaborate with language teachers to assist students to overcome difficulties encountered in reading, comprehension and writing. The Ghana Education Service (GES) should provide supplementary reading materials in science and mathematics for students at the junior secondary school level.

2. The GES, in collaboration with science and mathematics subject associations and the teaching universities, should provide regular in-service education and training (INSET) for science and mathematic teachers.

   The INSET should include the following:

   (a) construction of science and mathematics tests, especially multiple-choice and constructed response tests, to ensure most items in tests demand higher cognitive abilities;

   (b) introduction of a variety of assessment procedures including performance tasks, project work, laboratory practice, information gathering, interviews, problem solving and investigation tasks. This is in view of the fact that the type of assessment or test used by the teacher influences the learning that takes place;

(c) introduction of teachers to teaching strategies that take into consideration the diverse abilities, backgrounds, special needs and motivation of students. This is in view of the fact that majority of our schools and classrooms have multi-ability groups;

(d) exposure of science and mathematics teachers to creative and innovative teaching strategies such as constructivist's teaching strategies that encourage the involvement of the learner in order to reduce the teachers' reliance on the lecture method;

(e) provision of orientation to teachers to enable them teach the national curriculum in mathematics and science;

(f) provision of strategies for promoting professional development network among the science and mathematics teachers.

As part of the collaboration, the teacher education universities, UEW and UCC, should be taxed by the GES to provide INSET courses to address problems of pedagogy and content faced by JSS mathematics and science teachers.

Participation in such INSET activities should count towards performance appraisal for promotion.

3. The teacher education universities, UEW and UCC, and the teacher training colleges should re-examine the content and pedagogy of their mathematics and science education programmes to ensure that their products can not only effectively teach the topics included in the programmes but also encourage the development of higher cognitive abilities.

4. Currently, very few parents involve themselves in the academic work of their children, even though their involvement can enhance their children's performance. Parents can provide a conducive physical and psychological environment at home for learning. They should try to provide study tables/desks and books for use by their children in the home as this will demonstrate the seriousness they attach to education.

   Parents in addition should be encouraged to assist their children with their homework as well as participate in raising funds for schools, and participate in mathematics and science fairs. Appropriate strategies should be developed by schools to encourage their involvement.

5. The Science Technology and Mathematics Education (STME) Clinic, organised annually by the GES to encourage students, especially girls, to study science and mathematics at the pre-tertiary level, should be re-organised to ensure that its content addresses the difficulties encountered by students in science and mathematics. In view of the fact that most of the students are from economically disadvantaged areas, the geographical coverage should be such that the most rural schools are involved.

6. The Ministry of Education with the support of development partners should put in place measures to double the number of female teachers in mathematics and science in the next five years. More females should be encouraged to enrol in science and mathematics education programmes at the universities and the diploma awarding teacher training colleges. The universities should evolve strategies to encourage more females to enrol in mathematics and science programmes. Such incentives as scholarships and bursaries for female science and mathematics students in teacher education should be considered by the government.

7. The lack of computers in the junior secondary schools does not allow students to engage in certain cognitive activities such as carrying out scientific procedures, studying natural phenomenon through simulation, looking up information, analysing data and solving real life problems. A gradual attempt should be made to supply computers and associated software to all junior secondary schools. Where computers are available, they should be used to facilitate learning of science and mathematics. Before this, teachers should be given training to develop expertise in the use of computers for educational purposes.

8. The policy of not allowing the use of calculators in the classroom needs to be reviewed.

9. Effective science and mathematics teaching and learning requires adequate supply of both human and material resources. Resources for teaching science and mathematics should be made available to schools. The CRDD should make a list of basic resources required to implement the science and mathematics curricula and encourage schools to acquire as many of these as possible. District assemblies should assist in the provision of these resources.

10. The national curriculum for science and mathematics should be reviewed to emphasise the investigative and problem solving aspects of the subjects – designing, planning and conducting experiments or investigations, learning about technology and its impact on society, and solving non-routine problems.

11. Recommended textbooks and teacher’s handbooks that match the revised syllabuses for mathematics and science should be made available for teachers. The textbooks should meet the needs of the teachers. The Ministry of Education’s textbook policy, which provides schools with variety of textbooks on the same subject from different publishers, should be vigorously pursued.

12. Teachers should give more relevant and challenging homework (that demand higher cognitive abilities) to students. These assignments should be marked and discussed with students on time.

13. MOEYS to support structures such as science and mathematics clubs, school-university partnerships to promote the teaching of science and mathematics in rural and urban schools.

14. Inspectorate Division of the GES should be adequately resourced (with human, material and financial resources) to provide effective monitoring and supervision of instruction in science and mathematics in the schools to ensure that learning takes place.

15. The government should provide differential packages for science, mathematics, and technical/vocational teachers. This hopefully will reduce the high attrition rate in science and mathematics teachers as well as encourage graduate teachers to teach at the JSS level.

16. The CRDD of the GES should develop minimum competencies or standards of performance in science and mathematics to be mastered by students at JSS level. This will make teachers responsible for ensuring students' mastery of the defined competencies.

17. Government should provide adequate funding to support science and mathematics education in the junior secondary schools.

18. The Ministry of Education should continue to support Ghana's participation in future TIMSS so as to continue to monitor trends in Mathematics and Science education in the country.

19. The Ministry of Education should constitute the task force to study the recommendations and see to their implementation.

Finally

This summary has provided description of the performance of Ghana JSS2 students in mathematics and science together with the contextual factors that impact on effective learning. It has only presented a bird's eye view of the problem. A more detailed account can be found in the national report on Ghana's participation in TIMSS-2003.

Sources for this summary

Anamuah-Mensah, J., Mereku, D. K. and Asabere-Ameyaw, A. (2004) ***Ghanaian Junior Secondary School Students' Achievement in Mathematics and Science: Results from Ghana's participation in the 2003 Trends in International Mathematics and Science Study***, Accra: Ministry of Education Youth and Sports.

Mullis, I. V. S., Martin, M. O., Gonzalez, E. J., and Chrostowski, S. J. (2004) ***TIMSS-2003 International Mathematics Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades***, Chestnut Hill, MA: Boston Colege

Martin, M. O., Mullis, I. V. S., Gonzalez, E. J., and Chrostowski, S. J. (2004) ***TIMSS-2003 International Science Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades***, Chestnut Hill, MA: Boston College

Appendix A Average mathematics scale scores of eighth-grade students, by country: 2003

Country	Average score
International average[1]	466
Singapore	605
Korea, Republic of	589
Hong Kong SAR[2,3]	586
Chinese Taipei	585
Japan	570
Belgium-Flemish	537
Netherlands[2]	536
Estonia	531
Hungary	529
Malaysia	508
Latvia	508
Russian Federation	508
Slovak Republic	508
Australia	505
(United States)	**504**
Lithuania[4]	502
Sweden	499
Scotland[2]	498
(Israel)	496
New Zealand	494
Slovenia	493
Italy	484
Armenia	478
Serbia[4]	477
Bulgaria	476
Romania	475
Norway	461
Moldova, Republic of	460
Cyprus	459
(Macedonia, Republic of)	435
Lebanon	433
Jordan	424
Iran, Islamic Republic of	411
Indonesia[4]	411
Tunisia	410
Egypt	406
Bahrain	401
Palestinian National Authority	390
Chile	387
(Morocco)	387
Philippines	378
Botswana	366
Saudi Arabia	332
Ghana	276
South Africa	264

■ Average is higher than the U.S. average
□ Average is not measurably different from the U.S.
□ Average is lower than the U.S. average

[1] The international average reported here differs from that reported in Mullis et al. (2004) due to the deletion of England. In Mullis et al., the reported international average is 467.
[2] Met international guidelines for participation rates in 2003 only after replacement schools were included.
[3] Hong Kong is a Special Administrative Region (SAR) of the People's Republic of China.
[4] National desired population does not cover all of the international desired population.
***NOTE:** Countries are ordered by 2003 average score.*

***SOURCE:** International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2003.*

Appendix B Average science scale scores of eighth-grade students, by country: 2003

Country	Average score
International average[1]	473
Singapore	578
Chinese Taipei	571
Korea, Republic of	558
Hong Kong SAR[2,3]	556
Estonia	552
Japan	552
Hungary	543
Netherlands[2]	536
(United States)	**527**
Australia	527
Sweden	524
Slovenia	520
New Zealand	520
Lithuania[4]	519
Slovak Republic	517
Belgium-Flemish	516
Russian Federation	514
Latvia	512
Scotland[2]	512
Malaysia	510
Norway	494
Italy	491
(Israel)	488
Bulgaria	479
Jordan	475
Moldova, Republic of	472
Romania	470
Serbia[4]	468
Armenia	461
Iran, Islamic Republic of	453
(Macedonia, Republic of)	449
Cyprus	441
Bahrain	438
Palestinian National Authority	435
Egypt	421
Indonesia[4]	420
Chile	413
Tunisia	404
Saudi Arabia	398
(Morocco)	396
Lebanon	393
Philippines	377
Botswana	365
Ghana	255
South Africa	244

■ Average is higher than the U.S. average
□ Average is not measurably different from the U.S.
□ Average is lower than the U.S. average

[1] The international average reported here differs from that reported in Martin et al. (2004) due to the deletion of England. In Martin et al., the reported international average is 474.
[2] Met international guidelines for participation rates in 2003 only after replacement schools were included.
[3] Hong Kong is a Special Administrative Region (SAR) of the People's Republic of China.
[4] National desired population does not cover all of the international desired population.

NOTE: *Countries are ordered by 2003 average score.*

SOURCE: *International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS), 2003.*

TIMSS-2007

IEA has begun preparations for TIMSS 2007, the fourth assessment in the framework of the Trends in International Mathematics and Science Study. The previous assessments, conducted in 1995, 1999, and 2003, were very successful in measuring trends in student achievement in mathematics and science. TIMSS 2007 extends this sequence, providing achievement data at four time points over a 16-year period.

Target population

TIMSS 2007 will collect data in mathematics and science at fourth and eighth grades. In addition, following expressions of interest from a number of countries in assessing the final grade of schooling, TIMSS 2007 is offering an option to collect data at twelfth grade for students with advanced preparation in mathematics and two branches of science: biology and physics.

Although TIMSS 2007 is in its preliminary stages, several countries have expressed interest in participating including Ghana.

Schedule

TIMSS 2007 will start with the first National Research Coordinators (NRCs) meeting, on February 10–11, 2005 in Cairo, Egypt. Instrument development and field test activities will be carried out between February 2005 and April 2006. Data collection for the main survey has been scheduled for October–December 2006 (Southern Hemisphere) and April–May 2007 (Northern Hemisphere). The International Reports for grades fourth and eight will be released in December 2008, and the International Data Base and User Guide will be available in March 2009.

Challenge

How can Ghana's performance be improved in TIMSS 2007?

All suggestions and enquiries may be directed to:

The National Research Coordinator
TIMSS-2003
Inspectorate Division,
Ghana Education Service Headquarters
Accra